In the Drawings

The attached sheets of drawings replace all original sheets. Drawings changes have been made to Figure 19.

In Fig. 19, the areas "E" and "R" have been modified to correctly show the dimensions "R" and "E".

No new matter has been added.

Drawing Attachments: One Replacement Sheets of drawings

REMARKS

Claims 1-29 are pending in the present application. In the Office Action mailed July 7, 2005, the Examiner rejected claims 1, 3, 4, and 6 under 35 U.S.C. §103(a) as being unpatentable over Toth (USP 5,457,724) in view of Zhou et al. (US Patent Application 2002/0094064). The Examiner next rejected claim 2 under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Grass et al. (USP 4,578,806). Claim 5 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Kendrick et al. (US Patent Application 2003/0206614). Claim 10 was rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Grass et al. and Kendrick et al. Claim 12 was rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Fujimoto et al. (USP 5,386,446) and Hescht et al. (USP 5,212,437). Claims 15, 16, 19-21 and 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al. in view of Li (USP 6,459,755). Claim 29 is rejected under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et al., Li and further in view of Kendrick et al. Claims 7-9, 17, 18, and 28 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et al., and Li, and further in view of Lienard et al. (US Patent Application 2003/0007603). Claims 22, 24, and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth in view of Kendrick et al. Claim 26 is rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Kendrick et al. and further in view of Zhou et al. Claims 13, 14, and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et al., and Kendrick et al., and further in view of Kobayashi (USP 5,577,095).

The paragraphs on pages 18 and 27, as indicated above, have been amended to correct typographical errors. No new matter has been added.

The Examiner objected to Fig. 18 because E+C does not equal R+H. The Examiner also objected to Fig. 19 because E+R+L does not equal C. Applicant has amended the specification, as set forth above, to correct the description of the equations related to Figs. 18 and 19. Futher, enclosed herewith please find one sheet of replacement drawings to correctly show the dimensions "R" and "E" of Fig. 19. No new matter has been added.

The Examiner objected to claims 24 and 26 because of informalities. Applicant has amended claims 24 and 26 to address the objections raised by the Examiner. These amendments are deemed to satisfy the Examiner's objections of claims 24 and 26.

Applicant has amended claim 1 to incorporate the subject matter of claim 13. Although the Examiner rejected claim 13 under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et

al., Kendrick et al., and further in view of Kobayashi. Applicant believes claim 1, as amended, is in condition for allowance.

Specifically, the Examiner stated that Toth discloses determining the center of the subject from at least one scout scan. Office Action, July 7, 2005, p. 13. However, amended claim 1 calls for determining the center of mass of the subject from at least one scout scan and an elevational profile of the subject. The Examiner has not identified a teaching of determining the center of mass of the subject from at least one scout scan and an elevational profile of the subject in Toth, Zhou et al., or Kobayashi.

Toth discloses a system for estimating the physical center of a patient, not the center of mass of a patient, based on two orthogonal projections. Specifically, Toth discloses the acquisition of scout data that "is comprised of two orthogonal views from each slice position in the prescribed scan, one at a gantry angle of 0° and the other at an angle of 90°." Col. 3, lines 33-38. After the scout data is corrected for offsets and normalized to a reference detector, the scout data is filtered to "mask[ing] out attenuation due to undesired objects such as patient table, followed by low pass filtering the scout data using an 11 point box car filter." Col. 3, lines 43-45. Thereafter, "the edges of the patient are then located in each scout projection." Col. 3, lines 46-47. In this regard, "[t]he attenuation data for each detector element (i) in the projection is compared to a threshold (thresh=1.5) and the lowest detector [low0 and low90] and the highest detector [high0 and high90] located at the ends of the longest contiguous string of readings above the threshold are selected as shown in FIG. 4." Col. 3, lines 46-53. The low and high readings for both the 0° and 90° gantry angles are summed and then divided by two to give the "center 115 of the patient 15" location. Col. 3, line 54. In this regard, Toth teaches determining patient edges at two orthogonal views, summing the attenuation at the patient edges for both views, and then concluding that the physical center of the patient in the two orthogonal directions is located at the mean attenuation values, respectively.

In sum, Toth teaches a technique for identifying the physical center of a patient in two orthogonal directions based on the edges of the patient; such a technique is not equivalent to determining the center of mass of a patient. The "center of mass" is the point at which the total mass of the patient is assumed to be centered and upon which the sum of external forces can be considered to act, whereas Toth discloses a technique whereby the physical center of a patient is indirectly measured from the measured edges of the patient. Such a technique fails to account for asymmetrical subjects and can provide an incorrect assumption as to the center of mass when the center of mass is not located at the physical axial center of the subject.

The Examiner relied upon Zhou et al. in combination with Toth. Zhou et al. teaches an object positioner that "adjusts the position of an object to be imaged centrally within an imaging zone." ¶ 68. The object positioner places "an object between the x-ray source and the array or matrix of the detector." Id. As an example of positioning the object in the imaging zone, Zhou et al. states that "the object to be imaged is stationarily mounted onto the object positioner such that a centroid of the object to be imaged is positioned centrally within the imaging zone." Id. Zhou et al. further states that "the centroid can correspond to the physiological function to be monitored, such as the heart." Id.

Zhou et al. fails to teach determining the center of mass, or centroid, of the subject from at least one scout scan and an elevational profile of the subject. That is, while Zhou et al. teaches the desirability of positioning the centroid centrally within an imaging zone and equating the centroid to the physiological function to be monitored, Zhou et al. does not use the term "centroid", or an equivalent thereof, anywhere else therein. Thus, the determining of the centroid or center of mass of the object placed on the object positioner is not taught in Zhou et al. Instead, Zhou et al. merely states that that centroid of the object may be positioned centrally within an imaging zone or equated to the physiological function to be monitored. Id. Accordingly, one skilled in thee art looking to Toth to teach determining the centroid or center of mass of the object as taught in Zhou et al. would conclude that the center of the object based on the edges of the object corresponds to the center of mass. However, as described above, Toth does not determine the centroid or center of mass of the object.

Kendrick et al. also fails to teach or suggest determining the center of mass of the subject from at least one scout scan and an elevational profile of the subject. Instead, Kendrick et al. teaches detection of markers contained in a bodyframe that is attached to a patient. ¶ 9. Pre-procedural image data "localizes target tissue with respect to the bodyframe." Id. After determining a target tissue location and comparing the target tissue location with an isocenter location, magnitude and direction adjustments are generated to align the target tissue with the isocenter. Id. Determining a target tissue location, as taught in Kendrick et al., does not teach or suggest determining the center of mass of the subject from at least one scout scan and an elevational profile of the subject.

In addition to Toth, Zhou et al., and Kendrick et al., the Examiner relied upon Kobayashi. Kobayashi teaches illuminating an area on an examination body to visually depict an x-ray irradiation area or an image reconstruction area FOV. See col. 7, line 66 to col. 8, line 5. However, Kobayashi fails to teach determining the center of mass of the subject from at least one

scout scan and an elevational profile of the subject. Instead, an operator positions an imaging volume of interest of a patient by referencing visual illumination of the area to be imaged.

Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being claimed. That is, the art relied upon by the Examiner fails to teach or suggest determining the center of mass of the subject from at least one scout scan and an elevational profile of the subject. As such, Applicant believes that claim 1 and the claims that depend therefrom are patentably distinct from the art of record.

Applicant has amended claim 8 to call for the step of acquiring an elevational profile of the subject. Applicant has amended claim 14 to depend from claim 1. Since claims 8 and 14 depend from claim 1 and since claim 1 is deemed patentable over the art of record, claims 8 and 14 are deemed patentable at least through the chain of dependency.

The Examiner rejected claim 2 under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Grass et al. stating that "Grass et al. teaches determining from an isocenter of a radiographic energy fan beam. . . ." Office Action, supra at p. 4. While claim 2 is deemed patentable through the chain of dependency, Applicant additionally believes that the prior art fails to teach that called for in claim 2.

Grass et al. teaches that an "isocenter is more specifically defined as a point on the central X-ray of an X-ray beam extending from the focal spot of the X-ray tube to the center of an X-ray image receptor, such as an image intensifier, which point is intercepted by the horizontal and vertical axes about which the tube and receptor orbit or angulate jointly about the patient being examined." Col. 1, lines 53-59. However, while Grass et al. teaches a definition of an isocenter of an x-ray beam, Grass et al. fails to teach or suggest determining a distance of the center of mass of the subject from an isocenter of a radiographic energy fan beam as called for in claim 2. Grass et al. further teaches "a device for aligning and establishing and maintaining the isocenters of a lateral and a frontal X-ray imaging system in coincidence." Col. 2, lines 5-8. However, this device does not determine a distance of the center of mass of the subject from an isocenter of a radiographic energy fan beam. Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being called for in claim 2.

The Examiner rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al., and further in view of Kendrick et al. While claim 11 is deemed patentable through the chain of dependency, Applicant additionally believes that the prior art fails to teach that called for in claim 11.

Specifically, claim 11 calls for determining an adjusted projection area (PA) from a position of the center of mass of the subject after repositioning. As defined in the Specification, the projection area (PA) "is the sum of the attenuation values of the x-rays that intercept the patient." Specification, p. 20. As such, claim 11 calls for determining an adjusted sum of the attenuation values of the x-rays that intercept the patient from a position of the center of mass of the subject after repositioning.

The Examiner stated that "Toth does not specifically disclose determining an adjusted projection area from a position of the center after repositioning" and that "Kendrick et al. teaches adjusting, displaying, and repositioning. . . ." Office Action, supra at p. 6. The Examiner stated that it would have been obvious to incorporate the method of Toth "with the adjusting, displaying, and repositioning of Kendrick et al, since one would be motivated to make such a modification to make alignment more accurate. . . ." Id.

Kendrick et al. teaches calculating displacement values between an isocenter position and target coordinates of a tumor or target area. See ¶ 37. The displacement values, however, are not the sum of the attenuation values of the x-rays that intercept the patient. Thus, while Kendrick et al. teaches calculating displacement values between an isocenter position and target coordinates of a tumor or target area, Kendrick et al. fails to teach or suggest determining an adjusted projection area (PA) from a position of the center of mass of the subject after repositioning as called for in claim 11. Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being called for in claim 11.

Claims 15 and 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toth and Zhou et al. in view of Li. Applicant respectfully disagrees.

Claim 15 calls for, in part, a computer readable storage medium having stored thereon a computer program representing a set of instructions, which when executed by at least one processor, causes the at least one processor to determine a centroid of a subject. Claim 27 calls for a computer programmed to determine a centroid of the subject. The Examiner stated that Toth teaches determining a center of a subject but does not disclose positioning relative to a centroid. Office Action, supra at p. 9. While Toth teaches determining a center of a subject, Toth fails to teach or suggest determining a centroid of a subject, as described above.

Zhou et al., as described above, teaches an object positioner that adjusts the position of a centroid of an object to be imaged centrally within an imaging zone. ¶ 68. However, Zhou et al. is silent as to how the centroid is determined. That is, Zhou et al. does not teach, suggest, or enable one skilled in the art to determine a centroid of a subject or to determine the centroid of

the subject using at least one processor as called for in claim 15. At best, the combination of Zhou et al. and Toth teaches determining a center of a subject, assuming the axial center of the subject is the center of mass of the subject, and adjusting the center of the subject centrally within an imaging zone.

While Li teaches a computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to perform steps, Li fails to teach the computer performing a step of determining a centroid of a subject. Li fails to teach or discuss a "centroid" or a "center of mass".

Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being claimed. As such, Applicant believes that claims 15 and 27 and the claims that depend therefrom, respectively, are patentably distinct from the art of record.

The Examiner rejected claim 22 under 35 U.S.C. §103(a) as being unpatentable over Toth in view of Kendrick et al. Applicant has amended claim 22 to call for determining a centroid of the subject.

Neither Toth nor Kendrick et al. teach determining a centroid of a subject. As stated above, Toth teaches determining a center of a subject but does not teach determining a centroid of the subject. Kendrick et al. teaches calculating displacement values between an isocenter position and target coordinates of a tumor or target area; however, Kendrick et al. fails to teach or suggest determining a centroid of a subject.

Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being claimed. As such, Applicant believes that claim 22 and the claims that depend therefrom are patentably distinct from the art of record.

The Examiner rejected claims 7-9, 17, 18, and 28 under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et al., and Li, and further in view of Lienard et al. The burden of establishing a prima facie case of obviousness falls on the Examiner. MPEP §2142. To establish a prima facie case, the Examiner must not only show that the combination includes each and every element of the claimed invention, but also provide "a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). That is, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art." MPEP §2143.01. Applicant believes that a

prima facie case of obviousness has not been established and one cannot be made based on the art of record because there is no motivation to combine the references.

As stated above, Toth teaches a system for estimating the physical center of a patient, not the center of mass of a patient, based on two orthogonal projections. Specifically, Toth teaches "acquiring scout data which indicates the attenuation profile of a patient at two orthogonal views" and "calculating the center of the attenuation profile from the two orthogonal views. . . ." Col. 2, lines 9-19. As stated above, the patient edges are located in each attenuation profile, and the center of each profile is found by averaging a highest and lowest detector of each attenuation profile. See col. 3, lines 46-54. Thus, Toth teaches a technique for identifying the physical center of a patient from two orthogonal directions based on the edges of the patient; such a technique is not equivalent to determining the center of mass of a patient.

Lienard et al. teaches defining a region in which a projection of an imaging object is found on and x-ray image. See ¶ 17. After defining the region, a "means for processing 100 converts this region 22 into a volume 15, 16 for which it determines the position of the center of gravity." Id. The center of gravity position gives an estimate of a distance between an x-ray source and the imaging object. Id. The center of gravity position estimate is used "to calibrate the images which will be made of the object 45 and particularly to calculate the magnification factor f between the object 45 and the images." Id.

The Examiner stated that it would have been obvious to one skilled in the art "to incorporate the method of Toth as modified above with the scanning of Lienard et al., since one would be motivated to make such a modification to better estimate the distance of the object between components (paragraph 17) as implied from Lienard et al." Office Action, supra at p. 11. However, there is no suggestion in Toth that determining a reference point other than the center of the patient, as called for therein, is desirable or even needed. That is, Toth teaches finding the edges of a patient and finding a center located between the edges of the patient for determining x and y offset data and for calculating the radius of a scan field of view and the radius of a display field of view. The radius of the scan field of view is "the distance between the isocenter and an edge of the attenuation profile." Toth, col. 2, lines 9-19. The radius of the display field of view is "the distance between the attenuation profile center and the edge of the attenuation profile." Id. These values "become the default set-up for the scan which is subsequently performed. . . ." Toth, col. 4, lines 52-55.

Thus, Toth teaches finding the center and edges of a pair of attenuation profiles to calculate the x and y offset data and the display and scan fields of view radii. Lienard et al.

teaches determining a center of gravity of a region that neither identifies the edges of a patient nor the center of the patient as required by Toth to calculate the x and y offset data and the display and scan fields of view radii. Nor would it be obvious to one skilled in the art to combine the center of mass determination of Lienard et al. with the patient edge and center determinations of Toth since Toth does not teach, describe, or use a center of mass determination. While the Examiner concluded that such a modification would better estimate the distance of the object between components, the distance estimate found in Lienard et al. is a distance between the x-ray source and the object, not a distance between object edges as required in Toth.

Therefore, since it would not be obvious to one skilled in the art to combine Toth and Lienard et al. and since Toth fails to suggest finding a point other than a center of a patient, a prima facie case of obviousness has not been met by the Examiner.

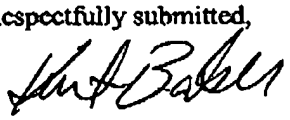
Furthermore, Lienard et al. discloses determining the position of the center of gravity of a volume of interest for each additional image obtained or, alternatively, a single estimate of the position of a volume of an object for all image acquisitions. See ¶¶ 20, 21. The center of gravity is determined from the region on the image containing a projection of the object. See ¶ 17. Since each image contains a projection of the object and since the calibration estimate is either known or calculated for each image, Lienard et al. does not teach or suggest repositioning the object to reduce a difference in position between a center of gravity thereof and a reference point. In fact, given that Lienard et al. teaches the determination of calibration estimates for each image, one skilled in the art would readily recognize that Lienard et al. teaches away from the purported combination. That is, the post-processing technique of Lienard et al. makes it unnecessary to reposition the subject to account for subject mis-centering. In other words, if center of gravity calibration estimates are determined for each image that is acquired and the respective images respectively calibrated, there is no need to reposition the subject. Therefore, it would not be obvious to one skilled in the art would to combine Lienard et al. with Toth.

The Examiner rejected claim 29 under 35 U.S.C. §103(a) as being unpatentable over Toth, Zhou et al., Li and further in view of Kendrick et al. As stated above with respect to claim 11, Kendrick et al. teaches calculating displacement values between an isocenter position and target coordinates of a tumor or target area but fails to teach or suggest determining an adjusted projection area (PA), or sum of the attenuation values of the x-rays that intercept the patient, according to the adjusted elevation of the subject as called for in claim 29. Therefore, the art relied upon by the Examiner fails to teach or suggest that which is being called for in claim 29.

Therefore, in light of at least the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1-12 and 14-29.

Applicant appreciates the Examiner's consideration of these Amendments and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,



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